

# **KING COUNTY CONVEYANCE SYSTEM IMPROVEMENT PROJECT**

## **NORTH SAMMAMISH SUBREGIONAL PLANNING AREA**

**FINAL TASK 210 REPORT  
FINAL TASK 220 REPORT  
FINAL TASK 230 REPORT**

**OCTOBER 2003**



*IN ASSOCIATION WITH*  
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# **KING COUNTY CONVEYANCE SYSTEM IMPROVEMENT PROJECT**

## **NORTH SAMMAMISH BASIN**

### **TASK 210, 220, AND 230 TECHNICAL MEMORANDUM**

#### **PLANNING, FACILITIES, and EXISTING CONDITIONS SUMMARY**

October 2003

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# **TASK 210 REPORT: NORTH SAMMAMISH BASIN PLANNING SUMMARY**

This King County's Conveyance System Improvement (CSI) report investigates the regional wastewater service needs for sewer basins located in the North Sammamish Basin, near the north end of Lake Sammamish. This report, covering Tasks 210, 220 and 230, contains background information on existing wastewater service, wastewater facilities and natural environment.

This first chapter contains a broad overview of basin characteristics and the area's planning history. The initial sections describe the planning area boundaries and identify the local agencies that collect wastewater within the planning area and discharge it to the King County Wastewater Treatment Division (WTD) conveyance system. Subsequent sections describe the existing environmental conditions within the planning area and summarize the basin's wastewater planning history since the 1958 *Metropolitan Seattle Sewerage and Drainage Survey*. The final sections in this chapter briefly focus on coordination of basin planning with King County's *Regional Wastewater Services Plan (RWSP)* and the impact on basin planning associated with Washington's Growth Management Act.

## **PLANNING AREA BOUNDARIES**

The North Sammamish Basin is located in central King County around the northern half of Lake Sammamish. Included within the basin is all sewerage area that drains towards King County's Hollywood Pump Station. The basin covers about 17,162 acres or nearly 27 square miles. Figure 210-1 shows the geographical extent of the basin.

With rising real estate prices in Bellevue and Redmond, urban growth pressures on the east side of Lake Washington shifted to the Sammamish Plateau in the late 1980s. The incorporation of the new City of Sammamish in 1999 is a reflection of this accelerated residential and commercial growth in the area. Sammamish Plateau population growth and capacity limitations in the Issaquah Interceptor, which serves King County's South Sammamish Basin service area, have combined to cause the King County WTD to consider diverting flows from the northern part of the Sammamish Plateau Water and Sewer District (the sewer collection agency serving Sammamish) northward, into the North Sammamish Basin. Thus the area covered by that proposed northern diversion is also included in the planning area studied here.

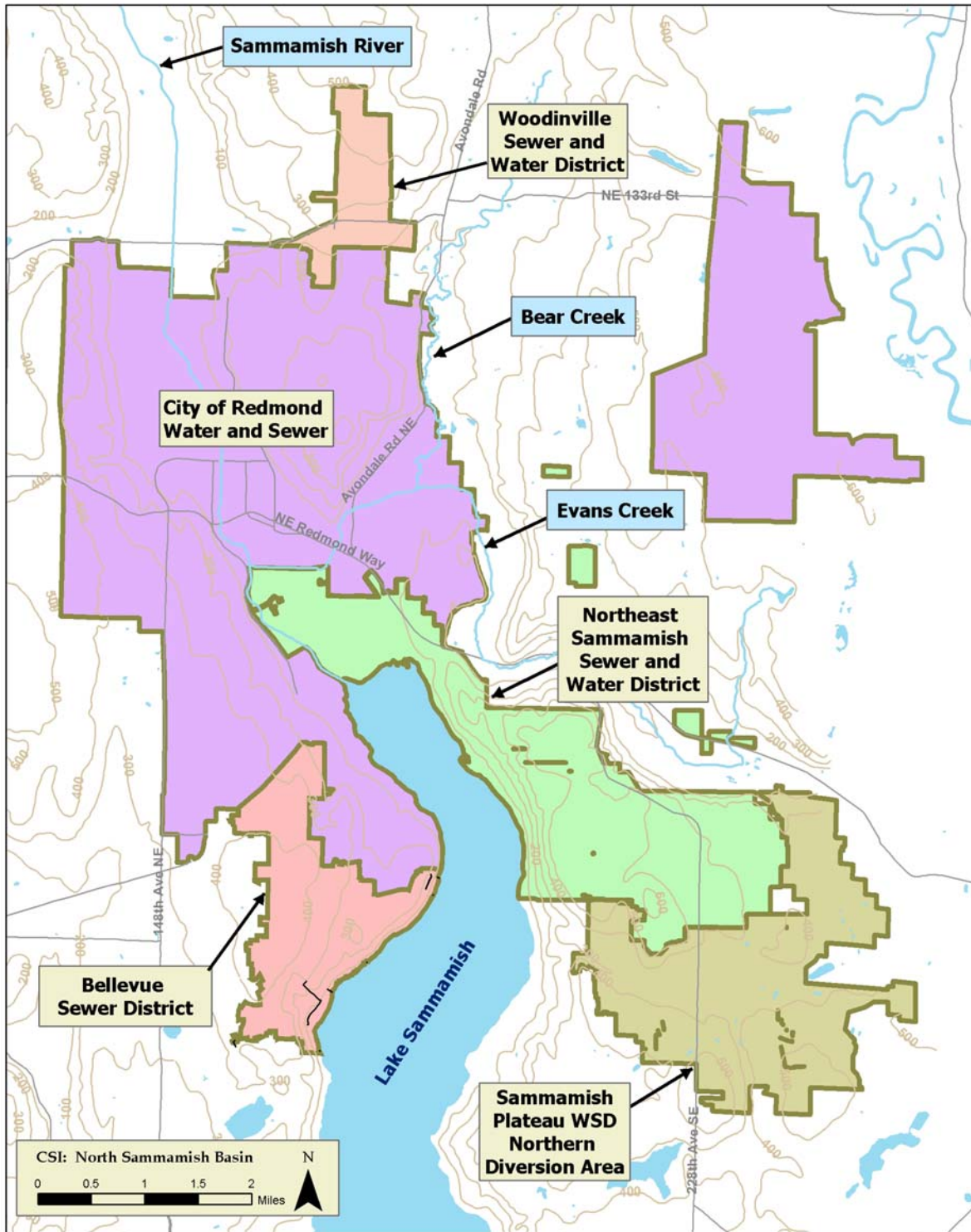


Figure 210-1. North Sammamish Basin Boundaries and Local Agencies



## **LOCAL SEWERAGE AGENCIES SERVING THE BASIN**

King County WTD wastewater conveyance facilities in the basin collect flows from the Northeast Sammamish Water and Sewer District (Northeast Sammamish WSD) at the northeast end of Lake Sammamish, Redmond, and parts of Bellevue to the west of Lake Sammamish. A small segment of the Woodinville's sewage conveyance system also lies within the basin. In addition, the future implementation of the CSI working alternative for the South Sammamish Basin would make the Sammamish Plateau WSD one of the North Sammamish Basin's service providers.

## **BASIN WASTEWATER HISTORY AND PLANNING CHRONOLOGY**

Like most of King County, the North Sammamish Basin has seen the pace of development escalate there during the last half century. In 1958, much of the basin was rural and the development that existed was served by on-site treatment systems. Now, however, the basin has become more urbanized, and most sewage is discharged to a public sewer. This section traces the historical development of sewerage systems within the basin during that period and summarizes the sewer planning conducted over the years to keep ahead of the service needs of the basin residents during that time.

### **History of Basin Development**

Over the past 45 years, the sewer services provided in the North Sammamish Basin have expanded as the service area has grown and developed. The following brief chronology highlights changes to the service area since the *1958 Plan*:

- During the 1960s, the City of Redmond annexed several large tracts within unincorporated King County, increasing its potential sewer service area from 193 acres to over 9,000 acres. Over time, the city's sewer collection system has expanded to serve most of the annexed acreage.
- In 1964, the newly created Municipality of Metropolitan Seattle (Metro) acquired the Lake Hills Treatment Plant from the Lake Hills Sewer District and operated it until 1974, when Metro abandoned the plant and began routing Lake Hills flows to its West Point Treatment Plant.
- In the early 1970s, the City of Bellevue annexed areas served by the Lake Hills Sewer District and took over that district's conveyance system assets. As a result, Bellevue's sewer conveyance system serves all of the land between Lake Washington and northern Lake Sammamish south of Redmond and Kirkland. Recent annexations by Bellevue have added areas south of Interstate 90, areas formerly served by the Eastgate Sewer District.

- In 1992, Metro, now King County, built the York Pump Station, which provided the operational option to route flow via the Eastside Interceptor to the South Plant at Renton. Previously, the Hollywood Pump Station would pump flow out of the North Sammamish basin to West Point for treatment. The York Pump Station is used primarily in the wet season.
- In the mid 1990s, final environmental impact statements for the planned unit developments of Northridge and Blakely Hill were issued, and a sewer line along Novelty Hill Road, from Northridge to the King County conveyance system (specifically, the County's NLS 33 facility) was constructed. Ownership of the Novelty Hill line was subsequently ceded to Redmond, and Northridge and Blakely Hill facilities were added to Redmond's collection system.
- In 2000, residents of unincorporated lands on the Sammamish Plateau, one of the fastest growing areas of King County, voted to incorporate as the City of Sammamish. The combination of rapid growth on the Sammamish Plateau and bottlenecks and capacity limitations along the Issaquah Interceptor (which presently provides conveyance for wastewater generated on the Sammamish Plateau) has produced a recommendation that sewage flows from the Sammamish Plateau WSD's northern area be diverted northward, into the North Sammamish Basin.

## **Wastewater Studies and Facility Planning within the Basin**

The following list summarizes, in chronological order, the plans covering North Sammamish Basin wastewater utility agencies published since the 1958 *Metropolitan Sewerage and Drainage Survey*.

1. Seattle Metro, *Pumping Stations Standby Generators Operation and Maintenance Manuals* (December 1979).
2. R. W. Beck and Associates, Inc., *Draft Bellevue Comprehensive Sewer Plan*, 1980.
3. CH2M Hill, Inc., *City of Bellevue Comprehensive Sewer Plan*, 1987.
4. RH2 Engineering, P.S., *Sammamish Plateau Water and Sewer District Amendment to Comprehensive Wastewater Plan*, October 1987.
5. Municipality of Metropolitan Seattle (Metro), *Final Plan for Secondary Treatment Facilities*, 1988.
6. King County *Sensitive Areas Map Folio*, 1990.
7. Brown and Caldwell, *City of Bellevue Comprehensive Sewer Plan Update* 1994.
8. HDR, Inc., and King County Department of Metropolitan Services, *Wastewater 2020 Plus Existing Conditions*, August 1994.

9. King County Department of Metropolitan Services, Water Pollution Control Department, *Offsite Facilities and Miscellaneous Structures Manual, Vol. 1, East Division* (1985, Revision B, December 1994).
10. City of Redmond, *Comprehensive Plan*, 1995.
11. King County Comprehensive Plan, 1996
12. City of Redmond, *Bear Creek Basin Sewer Plan*, 1996.
13. King County Department of Natural Resources, *Regional Wastewater Services Plan*, May 1997 Draft.
14. CH2M Hill, *City of Redmond General Sewer Plan*, October 1997.
15. King County Department of Natural Resources, *Regional Infiltration/Inflow Control Program, Local Agency Information*, 1998.
16. RH2 Engineers, Northeast Sammamish Sewer and Water District Sewer Comprehensive Plan, August 1998.
17. City of Bellevue, *2002 Comprehensive Wastewater Plan*.

### **Regional Wastewater Services Plan Coordination**

The *1958 Metropolitan Sewerage and Drainage Plan* (referred to herein as the *1958 Plan*) is the basic sewerage comprehensive plan for King County and its predecessor, Metro. The *Regional Wastewater Services Plan (RWSP)* was adopted in November 1999 as an amendment to the *1958 Plan*. Recent comprehensive wastewater plan amendments use population and employment forecasts and wastewater flow projections based on forecasts prepared by the Puget Sound Regional Council (PSRC).

The final *RWSP* adopted by the Council called for no new, major projects within the North Sammamish Basin. Capacity improvements were identified, and minor trunk sewer improvements were identified in the *RWSP*. The plan assumed that all basin flows would continue to be routed to the Lake Hills and Eastside Interceptors, while the trunk improvements were scheduled through 2030. By 2010, flows in the South Sammamish Basin could exceed the conveyance capacity of some regional facilities serving the basin, resulting in a need to divert some South Sammamish Basin flows northward.

## Growth Management Impacts

Most of the North Sammamish Basin lies within the urban growth boundary under the current King County Comprehensive Plan.<sup>1</sup> The Growth Management Act and the local agency comprehensive plans all require that new development within the urban growth boundary be sewerred. As the Northeast Sammamish system expands to include new developments, the areas within the urban growth boundary that are currently served by on-site systems will be required to connect to sewers. By 2020 to 2030, essentially all development in the planning area lying within the urban growth boundary should be connected to King County sewers, and all sewage generated within the urban growth boundary should be treated at one of King County WTD's regional treatment facilities. That assumption is consistent with the assumption that the *RWSP* planners made that by 2020, residential population and employment within the urban growth boundary would be 100 percent sewerred.

Affected agencies must prepare plans to finance and construct new facilities to serve the growth anticipated over the next 10 to 20 years. Bellevue completed its sewer plan update in 2000. The Northeast Sammamish SWD's *Sewer Comprehensive Plan* is only five years old, having been completed in 1998, and Redmond completed its sewer plan update in 1997. These three agencies expect that the local facilities necessary to convey their 20-year peak flows will be in place by the time they are needed as required by the Growth Management Act. King County WTD will need to confirm that its regional conveyance facilities within the basin will be adequate to accommodate the increased demand for sewage conveyance and treatment services.

## PLANNING AREA LAND USE

To properly size a proposed sewage conveyance facility, the critical question is always, "What is the peak flow rate that the facility will have to carry?" Sanitary sewage flows are related in part to the number of people whose sewage is being collected. This section examines the land use and population trends in the North Sammamish Basin. This information is intended to provide a partial basis for developing flow projections and performing capacity analyses of the North Sammamish Basin facilities.

Land use in the North Sammamish Basin planning area is predominantly residential, but several commercial centers are located in the basin, including the Redmond Town Center and parts of Bellevue. The degree of urbanization presently existing in the basin varies within the planning area. Until Interstate 90 was constructed, Lake Sammamish acted as a barrier to commuters. As a result, the urbanization on the Northeast Sammamish Sewer and Water District and the Sammamish Plateau is more recent than the urbanization of Bellevue and Redmond. Being the oldest community among those within the basin and being closest

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<sup>1</sup> King County WTD and local sewerage agencies serving the North Sammamish Basin provide wastewater service only within the urban growth boundary. Some of the local sewerage agencies provide water service but not wastewater collection services beyond the urban growth boundary.

to the Seattle job market, Bellevue is the most densely developed, followed by Redmond. The Northeast Lake Sammamish SWD serves less densely developed parts of the basin east of Lake Sammamish. As the eastern part of the basin becomes more urbanized, new businesses are likely to locate there to serve the growing population.

## **PLANNING AREA POPULATION GROWTH**

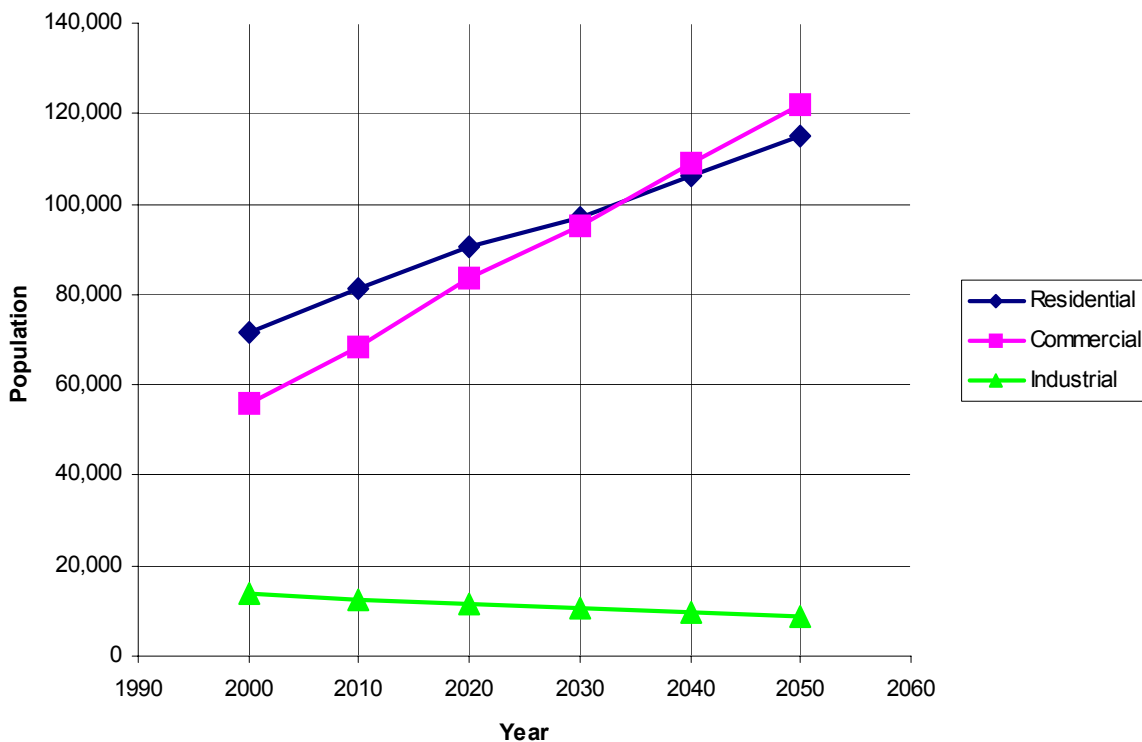
As noted earlier in this report, wastewater collection within the North Sammamish Basin is provided by four sewerage agencies, the Cities of Bellevue and Redmond, the Northeast Sammamish SWD, and the Woodinville Water District. The Sammamish Plateau WSD provides sewer service to the City of Sammamish, including the part of the planning area considered for diversion to and inclusion in the North Sammamish Basin.

Population estimates and forecasts are routinely prepared by the PSRC for use by local government agencies in planning infrastructure improvements. The PSRC forecasts are based on national, state, and region-wide census data, trends, and forecasts. Computer models disaggregate the population forecasts for larger areas into smaller blocks of contiguous acreage, known as forecast analysis zones (FAZs), and into still smaller blocks, known as traffic analysis zones (TAZs). To establish a population for a particular municipality or district, the population of each of the TAZs that comprise the city or district are reaggregated. This disaggregation/reaggregation process provides the population forecasts used by King County in its land use and infrastructure planning.

Figure 210-2 graphically depicts the forecasted residential population and employment growth in the North Sammamish basin through 2050<sup>2</sup>. While the commercial population will grow faster than residential population, commercial employment growth will be somewhat offset by a decline in industrial employment over the period. While the combined number of commercial and industrial employees will exceed the number of basin residents as early as 2010, because of wastewater use patterns, it is expected that the number of residents will have a greater impact on wastewater flow than the number of employees who work within the basin.

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<sup>2</sup> Populations included in Figure 2-1 include only the North Sammamish Basin as presently constituted and do not include the Sammamish Plateau WSD's northern diversion area.



**Figure 210-2. Forecasted Population of North Sammamish Basin through 2050**

Table 210-1 shows the PSRC residential population forecasts for each of the sewerage agencies that serve the basin through 2050. Because of the CSI project team’s recommendation that part of the Sammamish Plateau WSD service area be redirected toward the Northeast Sammamish Interceptor and into the North Sammamish Basin, the population forecasts for that part of the Sammamish Plateau WSD that would be transferred are included in Table 210-1 as part of the enlarged basin totals.

As Table 210-1 shows, the basin population growth rate is highest between 2000 and 2020. After 2020, the forecasted growth rate will fall to about half the rate expected during this first decade of the twenty-first century. Furthermore, growth will not be uniform throughout the basin. The Northeast Sammamish SWD and the parts of Bellevue that lie within the North Sammamish Basin will see only limited residential population growth in the coming decades. The parts of the basin likely to see the most population growth are outlying the sub-basins of the City of Redmond’s system and the portion of the Sammamish Plateau WSD proposed for transfer from the South Sammamish Basin.

**Table 210-1. Residential Population Forecasts for  
North Sammamish Basin Service Areas<sup>a</sup>**

<b>Service Provider</b>	<b>Acres</b>	<b>2000</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>
City of Bellevue	1,509	10,222	10,827	11,360	11,819	12,389	12,921
City of Redmond	12,254	50,404	58,106	65,855	71,594	79,328	86,459
NE Sammamish SWD	2,802	9,527	10,923	11,722	11,949	13,047	13,854
Woodinville	598	1,412	1,499	1,581	1,598	1,683	1,746
<b>Existing Basin Total</b>	<b>17,126</b>	<b>71,565</b>	<b>81,355</b>	<b>90,518</b>	<b>96,960</b>	<b>106,447</b>	<b>114,980</b>
Sammamish Plateau WSD transfer area <sup>b</sup>	2,823	7,339	7,948	8,608	9,322	10,096	10,933
<b>Enlarged Basin Total</b>	<b>19,949</b>	<b>88,904</b>	<b>89,303</b>	<b>99,126</b>	<b>106,282</b>	<b>116,543</b>	<b>125,913</b>

a. Forecasts for all basins in North Sammamish Basin based on revised 2003 King County/PSRC population forecast data.

b. Forecasts for Sammamish Plateau WSD based on 2000 and 2050 values from South Sammamish Basin Task 210 Report. Intermediate forecasts assume 8.3 percent per decade, straight-line population growth





## **TASK 220 REPORT: WASTEWATER FACILITIES SERVING THE NORTH SAMMAMISH BASIN**

This section reviews the existing wastewater facilities in the North Sammamish Basin that are owned and maintained by the King County Wastewater Treatment Division, as well as those owned and maintained by local sewerage agencies. The chapter includes a description of pumping and piping facilities.

The Northeast Sammamish SWD, the Cities of Redmond and Bellevue, and the Woodinville Water District collect and convey sanitary sewage from their local sewer systems to King County WTD trunk sewers and interceptors. Depending primarily on the time of year, WTD facilities pump wastewater either to the Eastside Interceptor, which carries wastewater to the County's South Treatment Plant at Renton, or to the Sammamish Valley Interceptor, which diverts the basin flows to the West Point Treatment Plant. The following sections describe the local collection agencies and the King County facilities serving North Sammamish Basin residents. Major King County wastewater conveyance pipelines and facilities serving the basin are shown in Figure 220-1.

### **WASTEWATER CONVEYANCE WITHIN THE BASIN**

During most of the year, wastewater from the basin flows by gravity to the York Pump Station, where it is pumped to the Eastside Interceptor and then flows by gravity to the South Plant at Renton. During dry, summer months, King County WTD will activate the pumps at the Hollywood Pump Station, diverting wastewater northward into the Sammamish Valley Interceptor, from where it will eventually travel via the Kenmore lake line to the West Point Treatment plant. This section describes the facilities used to convey basin flows to either plant.

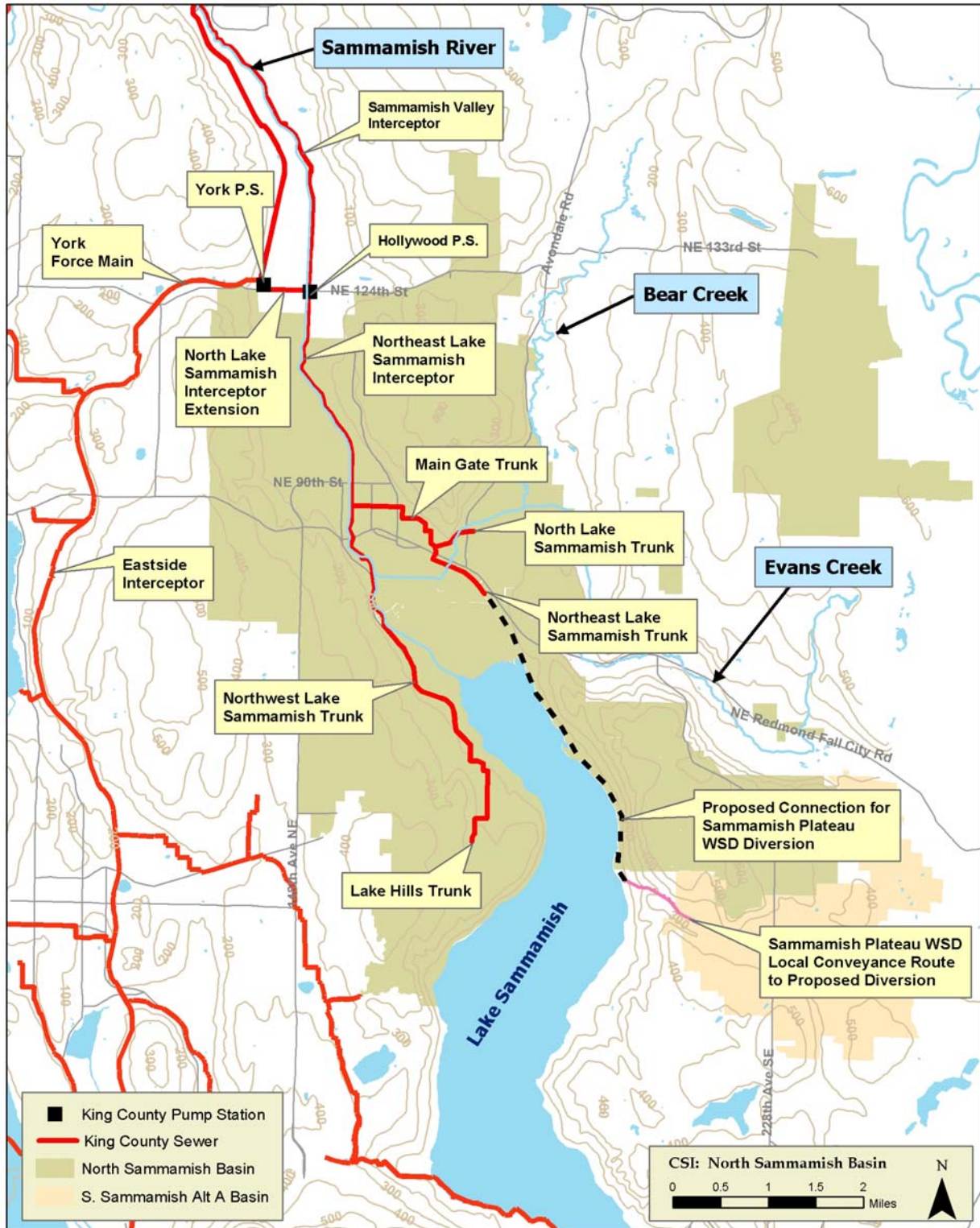


Figure 220-1: King County Facilities Serving the North Sammamish Basin

## **Local Agency Wastewater Facilities**

All North Sammamish Basin wastewater treated by King County WTD enters the County's conveyance system via connections to the one of four local sewerage collection agencies. The sub-sections below, which are based on information gathered from local agency comprehensive plans and other agency sources, describe general sewage flow patterns and major conveyance facilities operated by the local agencies.

### **City of Bellevue Facilities**

The oldest wastewater collection facilities within the North Sammamish Basin are operated by the City of Bellevue. Prior to the formation of the Municipality of Metropolitan Seattle (Metro), the Lake Hills Sewer District served northeastern Bellevue, operating its own wastewater treatment plant there. In 1964, Metro took over operation of the Lake Hills plant. About 10 years later, after construction of the Hollywood Pump Station and a network of new trunk sewers to convey flows there, Metro abandoned the Lake Hills plant and began sending wastewater from Lake Hills to its West Point Treatment Plant.

Bellevue's entire sewage collection system covers more than 40 square miles. The North Sammamish Basin study area includes about seven square miles (4,745 acres) of Bellevue's system. Over 100 miles of pipeline drain the portions of Bellevue that lie within the North Sammamish Basin. Table 220-1 lists the Bellevue sub-basins that lie within the North Sammamish Basin (i.e., that eventually flow to King County's Hollywood Pump Station). For each sub-basin, the table identifies the number of acres served, number of manholes, the number of feet of pipeline of varying diameter, and the number of pump stations. All of the sub-basins listed in the table are primarily residential; only Valley Creek, Crossroads, and Highland sub-basins contain more than 45 acres of commercial property. Nearly all of the sub-basins listed are currently 95 to 98 percent developed, and all will be fully built out by 2020.

In addition to the five pump stations in the Rosemont sub-basin, one flush station serves the sub-basin as well.

One concern about the Bellevue system generally is that, because of normal system development, and because parts of the system are nearly 50 years old, infiltration and inflow (I/I) in the Lake Hills part of the Bellevue collection system may have increased. Bellevue has not yet implemented a flow monitoring program to cover its aging pipelines in the Lake Hills area, and Bellevue flow projections include only an assumed 1,100 gallons per acre per day (gpac) for I/I contributions. Flow monitoring will be required to determine whether Bellevue's assumed I/I and total flow projections are accurate, and King County will conduct the flow monitoring within its ongoing regional I/I program.

**Table 220-1. Bellevue Sewer Basin Pipe and Pump Station Inventory<sup>a</sup>**

Sub-basin name (as per Bellevue Comp. Wastewater Plan)	Area (acres)	No. of manholes	Pipeline lengths (in linear feet)				Pump stations
			8-in dia. or less	>8-in to <12-in dia.	12-in to 18-in dia.	Total length	
Valley Creek	1,427	467	81,957	10,450	716	93,123	
Palisades	243	147	25,963	1,542		27,505	1
No. Larsen Lake	294	131	26,488	1,838		28,326	
Highland	326	162	32,021	2,450	20	34,491	
Chevy Chase	162	155	27,315			27,315	
Woodside	144	122	22,665			22,665	
Sherwood Forest	197	126	28,559			28,559	
Hidden Hills	136	112	22,829			22,829	
Crossroads	1,028	696	133,998	1,389	21,816	157,203	
Redmond	79	20	4,521			4,521	
Rosemont	383	244	52,628			52,650	5
Metro 52	326	171	30,351			30,351	
Total	4,745	2,553	489,295	17,669	22,552	529,560	6

<sup>a</sup> Source: City of Bellevue *Comprehensive Wastewater Plan*, 2002.

### City of Redmond Facilities

The first sanitary sewers in Redmond were constructed in 1958. Those first sewers served downtown Redmond and discharged to the city's sewage treatment lagoon. The lagoon operated until 1964, when Metro purchased the pump station at the lagoon and began diverting the wastewater to the Lake Hills Sewage Treatment Plant. In the early 1970s, Metro abandoned the Lake Hills plant and began diverting Lake Hills flows to its new North Lake Sammamish Interceptor.

During the 1960s, the sewer collection and conveyance system was expanded north and south of downtown Redmond as those areas developed. Since the 1960s, the system has expanded to serve most of Redmond within its corporate limits (an area that now encompasses about 9,200 acres in 31 sewer basins). By 1995, the system served nearly 14,000 residents and included more than 170 miles of sewer main, ranging in size from 8 inches to 27 inches. The City also owns 15 pump stations, six of which lift sewage from areas along the west shore of Lake Sammamish up into Redmond's gravity sewers. A number of privately maintained pump stations serving a small number of customers also discharge to the Redmond system.

Most of the development in the Redmond area has been relatively recent, and sewer mains tend to be in good condition. Typically, newer sewer systems admit less I/I (i.e., below 1,100 gpad). Flow monitoring would be required to confirm that Redmond contributes relatively low volumes of I/I to the King County system.

### **Woodinville Water District Facilities**

The Northeast Sammamish Basin wastewater flows also include flows from a small sub-basin (approximately 597 acres) served by the Woodinville Water District. The Woodinville East sub-basin includes about 1,400 residents. Sewage from the Woodinville East sub-basin flows south through a 10-inch diameter pipeline along 172<sup>nd</sup> Avenue NE. At NE 128<sup>th</sup> Street, the pipeline turns southeast for about 0.6 miles, then at NE 124<sup>th</sup> Street, the pipeline turns east and follows NE 124<sup>th</sup> Street for about 0.8 miles, to manhole R19-16D. The pipeline diameter gradually increases in diameter from 10 inches at its upper reach to 15 inches at manhole R19-16D, near King County's Hollywood Pump Station. At manhole R19-16D, two hand-operated slide gates divert the Woodinville wastewater either north, discharging it to the Sammamish Valley Interceptor via a 15-inch pipeline, or east and then south via a 16-inch diameter pipeline that discharges to manhole R19-6 and eventually to the Northeast Lake Sammamish Interceptor extension. At either location, the Woodinville East flows combine with wastewater from the rest of the North Sammamish Basin in a King County interceptor. Wastewater from Woodinville's East sub-basin is the only Woodinville sewage that can become part of the North Sammamish Basin flow and be directed to the Eastside Interceptor through the York Pump Station. All other Woodinville wastewater is directed northward, towards other King County conveyance facilities.

### **Northeast Sammamish Sewer and Water District Facilities**

The Northeast Sammamish SWD consists of 15 wastewater collection sub-basins covering about 2,400 acres. The District is served with 53 miles of pipeline, 13 lift stations that vary in capacity from 65 to 2,000 gallons per minute, and approximately 1,270 manholes. A pipeline inventory of the system is listed in Table 220-2.

**Table 220-2. Northeast Sammamish SWD Pipe Size Summary**

Pipe diameter (inches)	Gravity pipe length (miles)	Force main length (miles)
2		1.2
3		0.04
4		0.6
6	0.2	1.3
8	41.1	0.7
10	1.9	
12	0.9	1.1
15	1.5	
16		2.1
18	.7	
Total	46.3	6.9

Source: Northeast Sammamish Sewer and Water District *Sewer Comprehensive Plan* (RH2 Engineers, August 1998).

### **Sammamish Plateau Water and Sewer District Facilities**

The Sammamish Plateau WSD service area extends from the western edge of Lake Sammamish eastward beyond the Urban Growth Area (UGA) boundary. Sewer service is provided only within the UGA, while water service is provided throughout the District. According to Sammamish Plateau WSD staff, the area has seen significant residential development and sewer system expansion. The number of connections to the local system has nearly tripled in the past 10 years. In addition to single family homes, many of the newer developments include higher density residential and multi-family housing. There is also significant commercial development, particularly along the centrally located 228<sup>th</sup> NE Street corridor.

Sammamish Plateau WSD sewers presently drain to the southwest corner of the District service area, entering the County's Issaquah Interceptor near the south edge of Lake Sammamish State Park. The CSI working alternative for the South Sammamish Basin would divert a portion of Sammamish Plateau WSD flows northward into the North Sammamish Basin. Wastewater draining via the Inglewood Hills Road will be included in the diversion.

Continued development will continue to bring higher numbers of customers to the Sammamish Plateau WSD local system for the foreseeable future. Large tracts of undeveloped or sparsely developed land remain available, and the District expects to provide sewer service to all developable land within the urban growth area by 2020. Currently, the District requires new developments to tie into existing sewers, although in some instances, residents are allowed to install septic systems with the understanding that they will connect to the sewer system as the system expands into their area.

Table 220-3 summarizes the sewer facilities operated by the Sammamish Plateau WSD. Most of the local sewers range in diameter from 8 inches to 12 inches, although some sewer mains are as large as 36 inches in diameter. According to available data, approximately 10 percent of the District's sewers are larger than 12 inches in diameter. Although sewer construction materials vary, the majority of newer sewer mains and laterals are constructed of polyvinyl chloride (PVC) or high density polyethylene (HDPE). Because of the District's rapid growth, most of pipes are relatively new. The oldest pipes in the District are approximately 25 years old, but most pipes are less than 15 years old.

**Table 220-3. Summary of Sammamish Plateau WSD Sewer Facilities<sup>a</sup>**

Total length of sewers	~ 110 miles
Total length of sewers larger than 12-inch diameter	~ 10 miles <sup>b</sup>
Number of lift stations	16
Common pipe materials	PVC, HDPE, concrete, ductile iron
Range of pipe ages	Oldest ~25 years; Most less than 15 years

a Source: CSI Task 220 Report for South Sammamish Basin

b Estimated from available GIS data. Not all sewer pipes have associated diameter in GIS database.

## **King County Wastewater Conveyance Facilities Serving the Basin**

King County WTD operates a number of major trunk sewers, interceptors, pump stations, and force mains that serve the wastewater conveyance needs of North Sammamish Basin residents and businesses. In the paragraphs that follow, major WTD wastewater conveyance facilities serving the basin are briefly described. Those facilities are described beginning at the two upstream ends of the basin (i.e., on the west side and the east sides of Lake Sammamish) and extending downstream towards the Hollywood Pump Station and below.

### **Lake Hills Trunk Sewer**

The 10-inch to 27-inch diameter Lake Hills Trunk Sewer receives all flows from those portions of Bellevue lying within the North Sammamish Basin and from the Overlake South sub-basin of the City of Redmond. Originally constructed as part of the Lake Hills Sewer District system in 1959, it was acquired by the City of Bellevue in the 1960s with Bellevue's annexation of the Lake Hills Sewer District service area. The trunk sewer was subsequently acquired by Metro and King County. The Lake Hills Trunk Sewer pipeline is 24,096 feet long and constructed of asbestos-cement and reinforced concrete. At nearly 45 years old, the Lake Hills trunk includes the oldest segments of pipe serving the North Sammamish Basin. The collected Lake Hills trunk flows are discharged to the south (upstream) end of the Northwest Lake Sammamish Trunk Sewer.

### **Northwest Lake Sammamish Trunk Sewer**

The 18-inch to 42-inch diameter Northwest Lake Sammamish Trunk Sewer conveys all wastewater collected in the Lake Hills sub-basin and in Redmond's service area west of downtown Redmond. Constructed in 1972 and 1973, the trunk sewer is 10,753 feet long. The Northwest Lake Sammamish Trunk Sewer and the Main Gate Trunk Sewer both discharge into the Northeast Lake Sammamish Interceptor at 85<sup>th</sup> Avenue NE and NE 158<sup>th</sup> Street in Redmond.

### **Northeast Lake Sammamish Interceptor**

The Northeast Lake Sammamish Interceptor is a gravity pipeline that conveys wastewater collected within nearly all of the North Sammamish Basin<sup>3</sup> to the Hollywood Pump Station. The 72-inch diameter, 10,182-foot, reinforced-concrete interceptor was constructed in 1972 and receives flows from the Northwest Lake Sammamish Trunk Sewer and the Main Gate Trunk Sewer.

### **Proposed New Trunk Sewer to Serve Sammamish Plateau WSD Northern Diversion**

Looking at the North Sammamish Basin east of Lake Sammamish, the northern part of the Sammamish Plateau WSD has been proposed for diversion out of the South Sammamish Basin and away from the Issaquah Interceptor into the North Sammamish Basin. Such a diversion would require construction of a new pipeline extending southward from the upstream end of the Northeast Lake Sammamish Trunk Sewer for approximately 18,400 lineal feet to the intersection of Inglewood Hills Road and East Lake Sammamish Parkway, where the new interceptor would connect to the Sammamish Plateau WSD sewer running in Lake Hills Road. The new trunk sewer has been proposed in the basin plan for the South Sammamish Basin, but a specific alignment, pipe size, pipe material, and other specifications needed to construct the new pipeline have not yet been developed.

### **Northeast Lake Sammamish Trunk Sewer**

The 4,437 foot long Northeast Lake Sammamish Trunk Sewer was constructed in 1986 and 1987 to convey wastewater collected from within the Northeast Sammamish SWD service area to the Hollywood Pump Station. The 36-inch to 42-inch diameter, gravity pipeline is constructed of ductile iron and HDPE and discharges to the North Lake Sammamish Trunk Sewer in Redmond.

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<sup>3</sup> Only the flows from the Woodinville East sub-basin bypass the interceptor, flowing directly to the York Pump Station via a local 16-inch diameter pipeline and the Northeast Lake Sammamish Interceptor extension pipeline, or directly to the Sammamish Valley Interceptor when Hollywood pumps are running.



### **North Lake Sammamish Trunk Sewer**

The North Lake Sammamish Trunk Sewer is a 54-inch to 60-inch diameter, gravity pipeline that drains several sub-basins in eastern Redmond. The trunk was originally constructed in 1972, and except for a 76-foot segment made of ductile iron that was constructed in 1973, the trunk pipeline is made of reinforced concrete. The North Lake Sammamish Trunk Sewer discharges to the upstream end of the Main Gate Trunk Sewer.

### **Main Gate Trunk Sewer**

Constructed in 1970, the Main Gate Trunk Sewer was built to serve the Main Gate development in central Redmond. The gravity pipeline is constructed of 60-inch diameter reinforced concrete. Flow enters the Main Gate Trunk Sewer from the North Lake Sammamish Trunk Sewer, and the Main Gate trunk discharges to the Northeast Lake Sammamish Interceptor approximately 2,811 feet downstream.

### **Hollywood Pump Station**

King County's Hollywood Pump Station, located at 14815 NE 124<sup>th</sup> Street, Redmond, receives flow from King County's 72-inch Northeast Lake Sammamish Interceptor. Under wet weather conditions, the Hollywood Pump Station is shut down, and wastewater flows by gravity from the downstream end of the Northeast Lake Sammamish Interceptor to the York Pump Station via a 72-inch diameter Northeast Lake Sammamish Interceptor extension pipeline, bypassing the Hollywood Pump Station entirely.

During the dry season, the Hollywood Pump Station lifts wastewater from the Northeast Lake Sammamish Interceptor to the Sammamish Valley Interceptor, where it flows by gravity to the Woodinville Pump Station and on to the West Point Wastewater Treatment Plant. Hollywood Pump Station does not operate the rest of the year, and basin wastewater flows by gravity to the York Pump Station. This operating scenario is intended to alleviate summer odor problems in the Kenmore lake line while avoiding lake line overflows during wet weather. Figure 220-2 is a one-line drawing of the Hollywood Pump Station and its appurtenant structures.

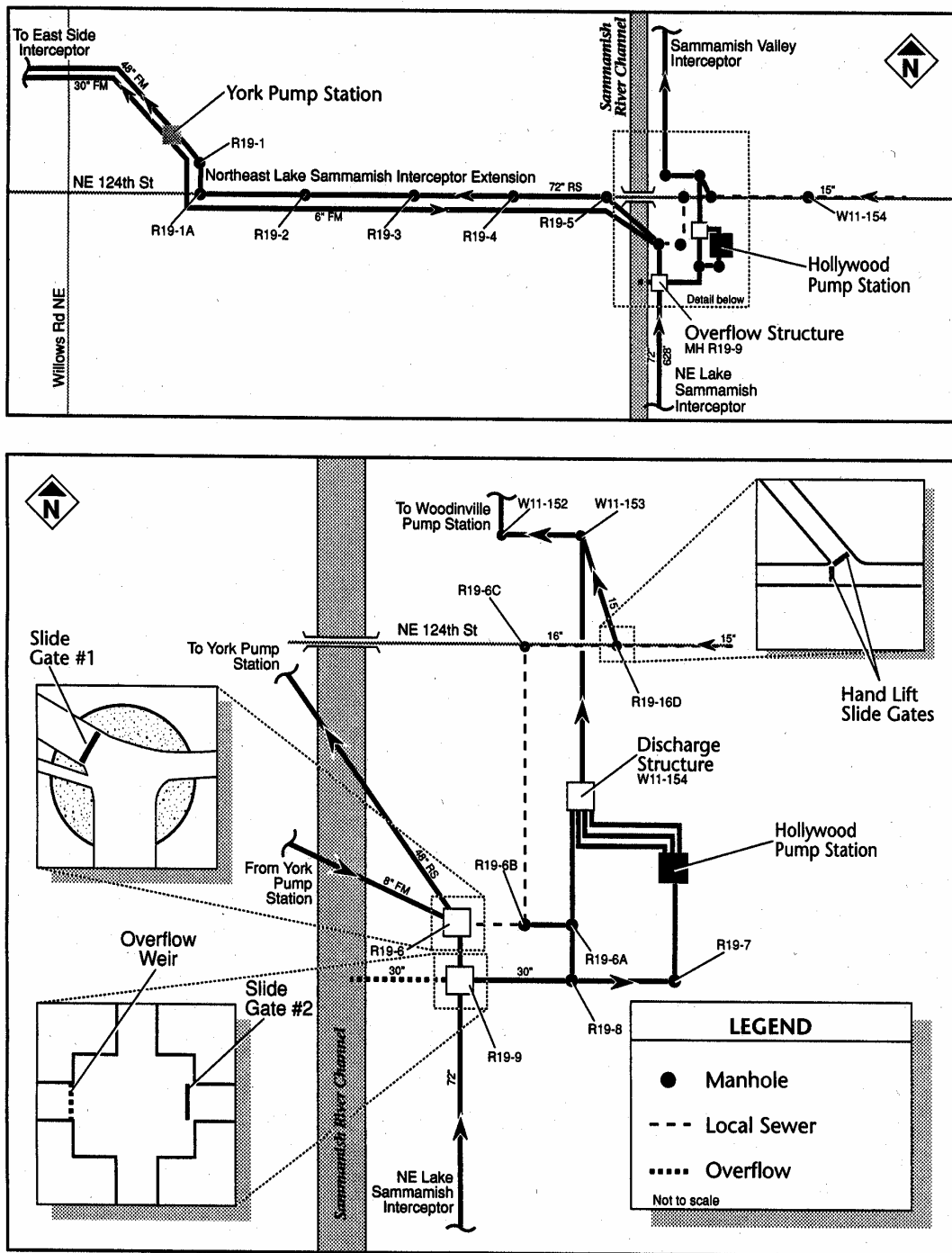


Figure 220-2. Hollywood Pump Station and Appurtenant Structures

The Hollywood Pump Station, which was completed in 1975, includes three (two duty, one standby) 7.2-mgd Aurora Spher-Flo pumps, powered by 444-hp Westinghouse electric motors, giving the station a firm capacity of 14.4 mgd. Flomatcher liquid rheostats provide speed control for the pump motors. Washwater, instrument air, heating, ventilation, and a hoist are provided. Odor control (via an activated carbon adsorber and a New York blower with a capacity of 1,330 cfm at 2,106 rpm) was added to the station in 1992. The station is powered by a single feed from Puget Sound Energy. No standby is installed at the Hollywood Pump Station. In the event of a power failure, flow can be routed to the York Pump Station.

Wastewater enters the station via a 30-inch diameter pipeline from manhole R19-9 in the Northeast Lake Sammamish Interceptor. The invert elevation of the influent pipeline is 105.20 feet. Wastewater is discharged from the station via three 16-inch diameter force mains, each with a midpoint elevation of 121.75 feet. Overflow protection is provided by an overflow structure at manhole R19-9, which discharges via a 30-inch pipeline to the Sammamish River. Overflow elevation is 124.2 feet. This same overflow structure provides protection for both the Hollywood and York Pump Stations.

King County WTD has concerns that by 2004, basin flow may cause the Kenmore lake line to exceed its capacity in summer. In that case, the Hollywood Pump Station would have to be shut down even during dry weather (and York Pump Station would have to operate year round). After the Brightwater Treatment Plant begins operating, the Hollywood Pump Station may operate year round, sending North Sammamish basin flow to Brightwater for treatment.

### **Sammamish Valley Interceptor**

As noted above, during the summer months, low flows in the Kenmore lake line can cause odor problems in that line. To minimize the lake line odor potential, North Sammamish Basin flows can be diverted into the lake line from the Hollywood Pump Station. Typically, King County starts the pumps at the Hollywood Pump Station to divert North Sammamish Basin flows into King County's 42-inch diameter Sammamish Valley Interceptor, from where it flows by gravity to the Woodinville Pump Station, the Kenmore Pump Station and lake line, and on to the West Point WWTP.

### **Northeast Lake Sammamish Interceptor Extension**

The Northeast Lake Sammamish Interceptor extension was completed in December 1989. In the winter months, the interceptor extension receives all flows from the North Sammamish Basin (including flows from the Northeast Sammamish Interceptor and from a local sewer that drains the Woodinville East sub-basin) and conveys those flows by gravity to the York Pump Station.

Flow enters the 2,700-foot long, 72-inch diameter Northeast Lake Sammamish Interceptor extension at manhole R19-5 (see Figure 220-2) via 232-foot long, 48-inch diameter, gravity pipeline from the Hollywood Pump Station bypass structure (manhole R19-6). The 48-inch,

reinforced concrete pipeline is relatively flat (the fall in the pipeline from its upper to lower end is only about 4 inches, from elevation 105.58 feet to 105.24 feet). The motor control center in the Hollywood Pump Station controls a 48-inch slide gate in the bypass structure to divert basin flows to the interceptor extension and York Pump Station or back to the Hollywood Pump Station and the Sammamish Valley Interceptor.

### **York Pump Station**

King County's York Pump Station, brought on-line in 1992, is located at the northeast corner of NE 124<sup>th</sup> Street and 140<sup>th</sup> Avenue NE. Flow from the North Sammamish Basin enters the York Pump Station wet well via the Northeast Lake Sammamish Interceptor extension. A 30-inch overflow discharge, located at near the Hollywood Pump Station, provides overflow protection.

Except during the summer, dry-weather conditions, the York Pump Station receives North Sammamish Basin wastewater and operates continuously. During the summer, however, basin wastewater is diverted northward at the Hollywood Pump Station, and the York station sits idle. A 6-inch force main runs from the York Pump Station wet well back towards the Hollywood Pump Station<sup>4</sup>, discharging into manhole R19-6, just west (upstream) of the Hollywood Pump Station. The 6-inch line is used for draining the York Pump Station wet well when the station is being shut down.

The York Pump Station has six sewage pumps with an estimated combined pump capacity of 58.0 mgd. The station operates on a dual-source electrical feed from Puget Sound Energy. Average wet-weather flow to the station in 2000 amounted to 10.6 mgd, and peak flows totaled 23.7 mgd. Odor control at the station is provided by an activated carbon adsorber and a New York blower with a capacity of 5,800 cfm at 1,684 rpm. Station heating, ventilation, washdown water, fire control water, air compression, and drainage equipment are also provided. Station control and monitoring are provided by a programmable logic controller. Current projects include installing an emergency generator.

King County's *Regional Wastewater Services Plan* includes a set of improvements to modify the York Pump Station so that it can use the North Creek Pump Station force main to pump flow to the North Creek Pump Station. (The North Creek force main is constructed so flow can be pumped in either direction.) This conveyance modification would increase flexibility in the conveyance system by allowing treatment of the North Sammamish basin wastewater at either the Brightwater Treatment Plant or the West Point Treatment Plant. That set of improvements to the York Pump Station is tentatively scheduled for construction in 2016.

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<sup>4</sup> In its description of the York Pump Station, *King County's Offsite Facilities and Miscellaneous Structures Manual, Volume 1, East Division*, describes the force main pipe as 6 inches in diameter, but the one line drawing of the Hollywood Pump Station in the same manual (used here as Figure 5) labels the pipeline as an 8-inch line.

### **York Force Main and Discharge to the Eastside Interceptor**

The York Force Main consists of two pipelines (one 30 inches in diameter, and the other 48 inches in diameter) that convey all wastewater collected in the North Sammamish Basin to the upstream end of the Eastside Interceptor from the York Pump Station. Because under normal operating conditions, all flows from the basin enter the York Pump Station and force main, the force main represents the normal downstream end of the North Sammamish Basin.

The York Force Mains discharge into the northern terminus of the Eastside Interceptor via a discharge structure located in the middle of 120<sup>th</sup> Avenue NE in Kirkland, just north of 120<sup>th</sup> Avenue NE's intersection with NE 116<sup>th</sup> Street. The discharge structure consists of two sections, both PVC lined. One structure encloses the downstream end of both force mains and two iron flap gates. The second section contains a Y-connector that connects the two force mains to the single 72-inch diameter interceptor pipeline. An odor control vault sits beside the discharge structure (also under the street) to treat foul air released from the wastewater during its discharge into the interceptor. Odor control is provided by a carbon scrubber.

### **REGIONAL CONVEYANCE CAPACITY AND FACILITY CONDITION**

At some time in the future, the condition of the facilities serving the North Sammamish Basin and their conveyance capacities may become a concern. For this study of the North Sammamish Basin, condition assessment and capacity analyses were not included in the scope of work for the CSI project team. To ensure that the regional conveyance capacity in the North Sammamish Basin is adequate to convey basin wastewater flows over the next 20 to 50 years, King County will need to develop flow projections (in part from the information developed in this report) and perform a complete capacity analysis, possibly including flow monitoring in the basin. Any questions concerning the condition of the regional facilities will need to be resolved by a condition assessment, possibly including sewer inspections. Determining the condition and/or the adequacy of conveyance capacity for the North Sammamish Basin are beyond the scope of this project and this report.



# **TASK 230 REPORT: EXISTING ENVIRONMENTAL CONDITIONS IN THE NORTH SAMMAMISH BASIN**

The North Sammamish Basin encompasses the land around the north end of Lake Sammamish and upper portion of the Sammamish River valley. The physical characteristics of the basin are important to the development of sewerage plans because they limit or impact pipeline routes and pipeline design and construction methods available.

## **TOPOGRAPHY**

The North Sammamish Basin lies within the Puget Sound lowlands, an area between the Cascade and Olympic mountain ranges that was carved away during the Vashon glaciation, about 10,000 to 12,000 years ago. Most of the basin is relatively flat, especially the Sammamish River valley that extends northward from the lake at an elevation of about 30 feet. The valley is flanked by steep slopes leading to relatively flat plateaus. The two highest elevations in the basin are found on the Sammamish Plateau, east of Lake Sammamish and served by the Sammamish Plateau Water and Sewer District (Sammamish Plateau WSD), and the new Northridge and Blakely Hill developments, across Bear Creek to the north of the Sammamish Plateau, and served by the City of Redmond. These areas both include residences about 600 feet above sea level. The areas nearest Lake Sammamish and along the Sammamish River represent the lowest elevations within the North Sammamish Basin.

The topography of the basin has influenced the pattern of development there. The lowlands were the first areas within the basin to develop. Those areas, comprising parts of Bellevue, Woodinville, and Redmond, are now essentially built out and have reached their maximum population densities. The upland parts of the basin, including the City of Sammamish, Blakely Hill, and Northridge, began developing more recently, and population can be expected to grow in those areas. Because population growth in the upland areas has been lower density than lowland development, the upland portion of the basin is the site of many on-site sewage treatment systems. With increased urbanization of the upland areas, more of the on-site systems will be abandoned in favor of connection to a local sewerage agency's collection system, and the basin's growth in sewered population will exceed the growth of the population generally.

## **CLIMATE**

The climate in the North Sammamish Basin is generally characterized by warm, dry summers and mild, wet winters. The average yearly temperature is around 50°F, with a typical summer high temperature around 75°F and a typical winter low near 32°F. The

average yearly precipitation is about 45 inches and occurs mostly October to April. Snow occasionally falls during the winter, but snowfall seldom remains for more than a day or two. The prevailing winter winds are generally from the south, shifting to north and northwest during late spring and summer.<sup>5</sup>

## **GEOLOGY AND SOILS**

Erosion and flooding following the last ice age resulted in soil deposits of four primary classifications as identified by the Soil Conservation Service of the U.S. Department of Agriculture. The soil types are the Alderwood Series, the Everett Series, the Puget-Earlmont-Snohomish Series, and the Indianola Series.

Alderwood Series soils are moderately well drained, undulating to hilly soil, underlain by dense, slowly permeable glacial till at depths of 20 to 40 inches below the surface. Because of the low permeability of the subsoils, seasonal groundwater tables rise to within 2 to 3.5 feet of the surface. The Alderwood Series soils are found in the upland areas and terraces on either side of the Sammamish Valley.

The Puget-Earlmont-Snohomish Series soils are found along the Sammamish River and Bear Creek. The soils of this series are nearly level, poorly drained, and have layers of peat near the surface. Seasonal groundwater tables typically lie 0 to 2 feet below the surface.

Most of downtown Redmond is situated on Everett Series soils. These soils are glacial outwash, characterized by excessively drained, gravelly soils underlain by sand and gravel.

The Indianola Series consists of excessively drained soils formed under conifers in sandy, recessional, stratified glacial drift. Indianola Series soils are found on terraces with slopes of up to 30 percent, such as south of Bear Creek.

## **WATER RESOURCES**

The surface water resources in the basin include a major lake and river and several important creeks. Groundwater is also a concern for basin planners, especially during the wet winter months.

### **Surface Water Resources**

The North Sammamish Basin includes two major surface water resources: the Sammamish River and Lake Sammamish. The Sammamish River, flowing north from Lake Sammamish into Lake Washington, is shown as a Class 1 stream in King County's *Sensitive Area Folio*. Lake Sammamish is a major recreational resource for King County residents, and its water

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<sup>5</sup> Source: CH2M Hill, *City of Redmond General Sewer Plan* (October 1997).



quality is designated Class A, Excellent by the Washington State Department of Ecology (Ecology). In addition to the lake and river, the North Sammamish Basin includes Bear Creek also a Class I stream, and its tributaries, including Evans Creek.

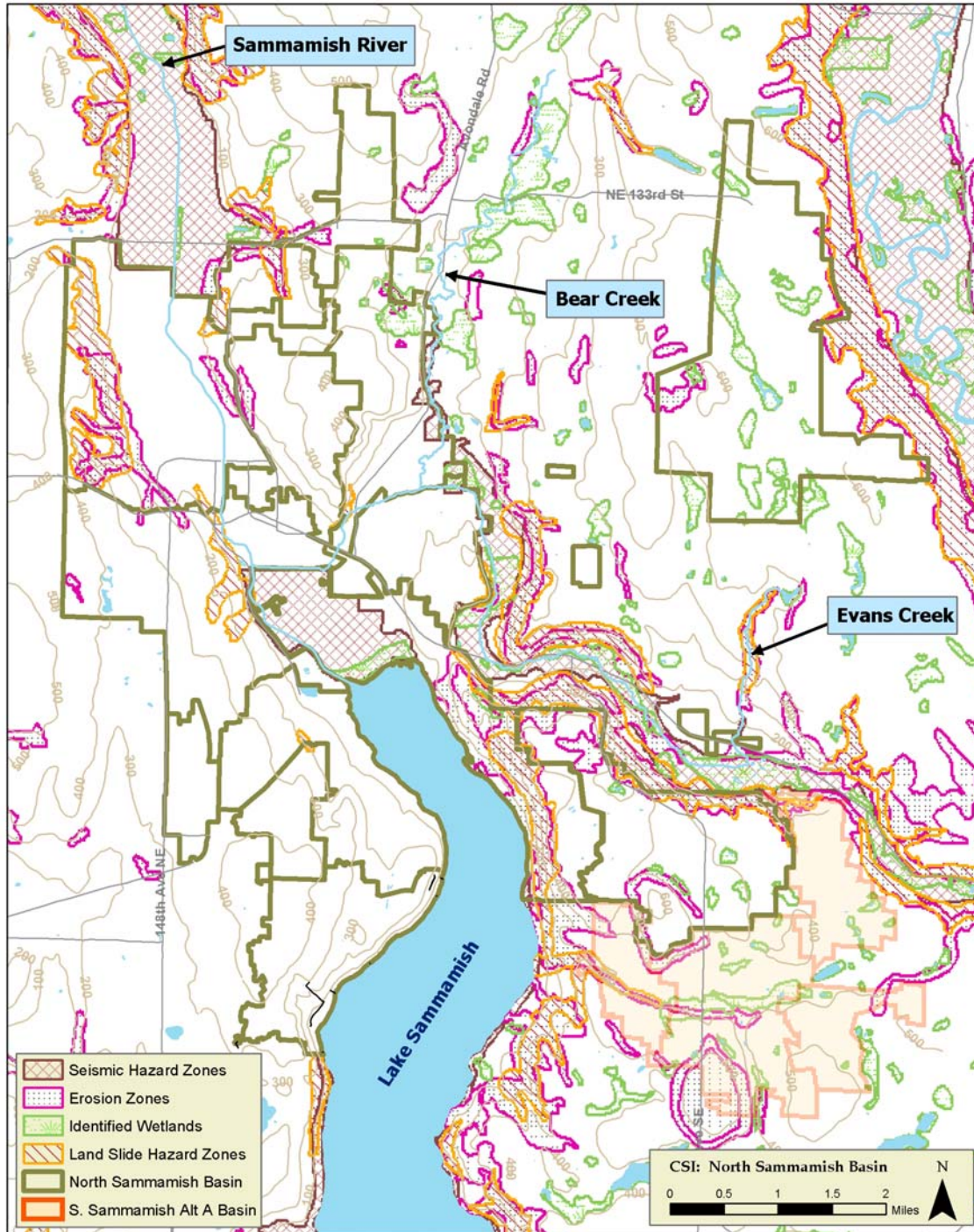
## **Groundwater Resources**

The combination of glacially-compacted soils and hardpan, together with heavy winter rainfall, results in areas of seasonal high groundwater as rainfall penetrating the soil surface encounters hardpan and remains perched near the surface. The potential for groundwater infiltration during the wet weather season can be high, depending on the condition of the collection system.

Historically, groundwater has been the primary drinking water source for basin residents. Redmond, for example, has until recently depended on four wells for its public water supply. A 1986 groundwater availability study by the City of Redmond showed that the groundwater supply was limited. As a result, Redmond began negotiating contracts with neighboring water purveyors, including the City of Seattle, to reduce its reliance on groundwater.

## **SENSITIVE AREAS**

Several parts of the North Sammamish Basin are considered environmentally sensitive. These sensitive areas are protected by King County ordinance and are shown on Figure 230-1. Sensitive areas include lands adjacent to Lake Sammamish and the streams mentioned above, numerous wetlands and flood hazard areas near the lake and along the streams, and steep slopes and erosion areas separating the lowlands along the Sammamish River and Lake Sammamish from the upland areas to the east. Of particular concern are wetlands and seismic areas along the north and northeast east shores of Lake Sammamish and an erosion zone running more or less continuously along Lake Sammamish's east shore, separating the lake from the Sammamish Plateau. King County has designated the slopes below the western edge of the Sammamish Plateau a "No Disturbance Zone." In the event that a pipeline must be constructed to bring the Sammamish Plateau WSD northern diversion area (cross-hatched in red on Figure 230-1) into the North Sammamish Basin, pipeline construction crews would have to take special mitigation measures to protect these sensitive areas and to protect the new pipeline against failure.



**Figure 230-1. Sensitive Areas in the North Sammamish Basin**